40 CFR Part 194 Requirements Identified By EPA As Requiring Additional Information in DOE's CCA Prior to Any Determination of Completeness by the Agency

Content of Compliance Certification Application

194.14(a)(2)
Part 194 requires that the CCA include for all geologic units within the disposal system the following general hydraulic characteristics:

- hydraulic conductivity;
- storage coefficient;
- transmissivity;
- permeability;
- thickness;
- matrix and fracture characteristics; and
- hydraulic gradients.

Section 2.2 of the CCA indicates that these characteristics have been evaluated for all geologic units in the disposal system. However, it is not apparent that all of the required information is presented.

What follows is an incomplete table which presents information extracted from Chapters 2 and 6 of the CCA and Room Q experiments (Domski et al., 1996) which DOE could revise to present the necessary information. This information should be provided (in the table or other form) as part of the analysis documentation.

COMPLETENESS DETERMINATION TABLE FOR 194.14(a)(2)

Unit		Hydraulic Conductivity	Storage Coefficient	Transmissivity	Permeability	Thickness	Matrix * and Fracture Char.	Hydraulic Gradients
Santa Rosa		--	Specific capacity 0.029 to 0.041 liters/sec/meters (2.2.1.4.2.2)	--	10^{-10} m^2 (Table 6-24)	0 to 91 m (2.2.1.4.2.2) 0.6 to 78 m (2.1.3.7)	--	--
Dewey Lake		10^{-8} m/s (2.2.1.4.2.1)	--	--	5.01 x 10^{-17} m^2 (Table 6-23)	149.3 m (Table 6-23) 152 m (2.1.3.6)	2.2.1.4.2.1 and 2.1.3.6	--
Rustler	Forty-niner	--	--	8 x 10^{-8} to 3 x 10^{-9} m^2/s (Table 2-4 and 2.2.1.4.1.5)	0 m^2 (6.4.6.5)	17.3 m (6.4.6.5) 13 to 23 m (Table 2-4 and 2.1.3.5.5)	--	--
	Magenta	--	--	4 x 10^{-4} to 1 x 10^{-9} m^2/s (Table 2-4 and 2.2.1.4.1.4)	6.31 x 10^{-16} m^2 (Table 6-22)	7.9 m (2.2.1.4.2) 7 to 8.5 m (Table 2-4, 2.1.3.5.4 and Table 6-22)	--	3 to 6 m/km (2.2.1.4.1.4)
	Tamarisk	--	--	<2.7 x 10^{-11} m^2/s (Table 2-4)	0 m^2 (6.4.6.3)	24.8 m (6.4.6.3) 26 to 56 m (Table 2-4 and 2.3.5.3)	--	--
	Culebra	--	--	1 x 10^{-3} to 1 x 10^{-9} m^2/s (Table 2-4 and 2.2.1.4.1.2)	2.1 x 10^{-14} m^2 (Table 6-18)	4 to 11.6 m (Table 2-4) 7.7 m (Table 6-18) 11 m (2.1.3.5.2)	2.1.3.5.2 and 2.2.1.4.1.2	--
	unnamed lower member	6 x 10^{-15} to 1 x 10^{-13} m/s (2.2.1.4.1.1) 1.5 x 10^{-11} to 1.2 x 10^{-11} m/s (basal interval) (2.2.1.4.1.1)	--	2.9 x 10^{-10} to 2.2 x 10^{-13} m^2/s (Table 2-4) 2.9 x 10^{-10} to 2.4 x 10^{-10} m^2/s (basal interval) (2.2.1.4.1.1)	0 m^2 (6.4.6.1)	29 to 38 m (Table 2-4 and 2.1.3.5.1)	--	--

COMPLETENESS DETERMINATION TABLE FOR 194.14(a)(2)

Unit		Hydraulic Conductivity	Storage Coefficient	Transmissivity	Permeability	Thickness	Matrix * and Fracture Char.	Hydraulic Gradients
Rustler-Salado Contact Zone		--	--	3.2×10^{-11} to 5.4×10^{-8} m^2/s (Table 2-4) $3.2 \times 10^{-11}$to 8.6×10^{-6} m^2/s (2.2.1.5.2)	--	3 to 18 m (Table 2-4) 2.4 to 33 m (2.2.1.5.2)	--	0.27 to 7.4 m/km (2.2.1.5.2)
Salado	Impure Halite	2.7×10^{-22} m/s (Domski et al. 1996, Room Q)	Storativity 2.1×10^{-6} Spec. Storage 2.5×10^{-6} m^{-1} (Domski et al. 1996, Room Q)	1.3×10^{-15} m^2/s (Domski et al. 1996, Room Q)	2.3×10^{-22} m^3 (permeability-thickness) (Domski et al. 1996, Room Q) 1×10^{-23} to 4×10^{-18} m^2 (2.2.1.3) 10^{-21} to 10^{-24} m^2 (Table 6-14)	up to 600 m (2.1.3.4)	--	
	Anhydrite	4.3×10^{-13} m/s (Domski et al. 1996, Room Q)	Storativity 2×10^{-7} Spec. Storage 3.3×10^{-6} m^{-1} (Domski et al. 1996, Room Q)	2.6×10^{-14} m^2/s (Domski et al. 1996, Room Q)	4.5×10^{-21} m^3 (permeability-thickness) (Domski et al. 1996, Room Q) 2×10^{-20} to 7×10^{-18} m^2 (2.2.1.3) 7.94×10^{-18} to 10^{-21} m^2 (Table 6-15)	Fig. 2-8	Table 6-16	
	Marker Bed 139	3.4×10^{-13} (Domski et al. 1996, Room Q)	Storativity 6.6×10^{-8} Spec. Storage 4.4×10^{-7} m^{-1} (Domski et al. 1996, Room Q)	5.1×10^{-14} m^2/s (Domski et al. 1996, Room Q)	7.94×10^{-18} to 10^{-21} m^2 (Table 6-15) 8.9×10^{-21} m^3 (permeability-thickness) (Domski et al. 1996, Room Q)	0.85 m Fig. 2-8	Table 6-16	
Disturbed Rock Zone		--	--	--	10^{-15} m^2 (Table 6-17)	--	--	
Castile	Brine Pockets	--	--	--	2×10^{-15} to 1.58×10^{-10} m^2 (Table 6-26)	--	2.1.3.3 and 6.4.8	

COMPLETENESS DETERMINATION TABLE FOR 194.14(a)(2)								
Unit		**Hydraulic Conductivity**	**Storage Coefficient**	**Transmissivity**	**Permeability**	**Thickness**	**Matrix * and Fracture Char.**	**Hydraulic Gradients**
	Castile	--	--	--	--	301 m (2.1.3.3)	2.1.3.3	
Bell Canyon		1.7×10^{-7} to 3.5×10^{-12} m/s (2.2.1.2.1)	--	--	--	1,000 ft (2.2.1.2.1)	--	25 to 40 ft/mile (2.2.1.2.1)

-- Information needs to be provided in the CCA.

* Aspects of matrix characteristics are often considered in discussions in the text. The section reference, or lack of a section reference, in this column refers to fracture characteristics.

194.14(a)(2)
Part 194 requires a description of the geology, geophysics, hydrogeology, hydrology, and geochemistry of the disposal system and its vicinity and how these conditions are expected to change and interact over time.

The CCA does not include updated information obtained from recent site investigation-related studies. The CCA states that "these recent studies... provide detailed information necessary to construct the conceptual models," but does not summarize what these studies entailed and how they impact the understanding of site characteristics relative to older data. The CCA implies, on page 2-9, Section 2.1, that these data are included in Chapter 6 and associated appendices.

The CCA should include more detailed information pertaining to the more recent studies so that an understanding of the site conditions and linkages of this information with the conceptual model development can be achieved. In addition, the CCA should provide a discussion of newly acquired site-specific information (i.e., information on Culebra and retardation studies presented at the 10/11/96 meeting between DOE and State of New Mexico representatives), and discuss how this information impacts site conceptual model development.

194.14(a)(3)
Part 194 states that the CCA must provide the presence and characteristics of potential pathways for transport of waste from the disposal system to the accessible environment including, but not limited to: existing boreholes, solution features, breccia pipes, and other potentially permeable features, such as interbeds.

The CCA includes information pertaining to the Salado Formation marker bed presence and

briefly describes these features in Chapter 3, GCR, and HYDRO. However the presence of pre-existing fractures within the marker beds is not addressed in sufficient detail to gain an understanding of the in-situ (i.e., pre -WIPP) fracture conditions within marker beds, from a geologic basis. CCA Section 6.4.5.2 addresses how the interbeds are "managed" in the PA, indicating, for example, that marker beds contain previous fractures that may be partially healed (Appendix MASS13.3 and PAR-36). However, the density, nature, and extent of fractures within marker beds, pertinent test results, etc., should be discussed in greater detail.

The CCA should be revised to include a more detailed discussion regarding the nature, extent, geologic characteristics, etc., of pre-existing fractures within Salado Formation marker beds.

Quality Assurance

194.22(a)(2)(iii)
Part 194 states that the CCA shall contain information on the QA program applied to meteorologic characteristics.

CCA Chapter 5 does not contain information on the QA program applied to meteorological characteristics.

The CCA needs to include meteorological information or state why a QA program was not applied to meteorological characteristics.

Models and Computer Codes
Part 194 requires that the CCA include a description of conceptual models and scenario construction used to support the CCA. In addition, Part 194 states that documentation of all models and computer codes must be included.

There is a significant problem with the completeness of the CCA documentation that deals with the CCDF formalism and the codes that implement it. While the current versions of the formalism and codes may be doing exactly what is required of them, and while those intended activities may be what is needed for the PA, it is often difficult and sometimes impossible to determine what it is, exactly, that they *are* doing, and to *verify* that this is all happening as intended. The documentation is, in places, too sparse to enable a reviewer to acquire a comprehensive understanding of the current form of the formalism and codes.

DOE needs to provide documentation for the CCDF formalism and for the codes that implement it. Specific examples are provided below.

194.23(a)(1)
Part 194 requires a description of the conceptual models and scenario construction used to support the CCA.

No discussion is provided in the NUTS User's Manual of the numerical implementation of precipitation, or on colloidal preferential solubility.

The CCA needs to include(in the NUTS User's Manual) numerical implementation of precipitation, and colloidal preferential solubility information.

194.23(a)(2)
Part 194 requires a description of plausible, alternative conceptual model(s) seriously considered but not used, and an explanation of the reason(s) why such model(s) was not deemed to accurately portray performance of the disposal system.

(1) While the application describes the conceptual models used for cuttings, cavings, and spallings, there is little discussion of any alternative models that may have been evaluated.

The CCA needs to provide a more complete discussion of alternative models seriously considered. This comment also applies to all model conceptualization in the CCA PA. If there are no other plausible, alternative models, this should be stated clearly in the CCA.

(2) The Culebra is described as having heterogeneous transmissivity (CCA page 6-124, line 2-3) and uniform porosity (CCA page 6-129, line 20-26). Given the fact that flow in the Culebra is conceptualized as being predominantly in fractures, the porosity should vary with hydraulic conductivity (and transmissivity since the thickness is constant).

Future changes in the Culebra transmissivity due to dissolution need to be discussed, or reasons need to be given for discounting this alternative conceptualization of the Culebra.

194.23(a)(3)(i)
Part 194 requires that documentation be provided to substantiate that conceptual models and scenarios reasonably represent possible future states of the disposal system.

In the Design Document specification for Appendix CCDFGF, the map of 144 specific locations to model for intrusions implies that location-specific probabilities were used to ascertain whether brine would be encountered at each of these locations. Yet, the documentation in Appendix MASS implies that a fixed value near 8% was used for all locations.

The CCA needs to clarify the inconsistency between site-specific brine information and the fixed 8% value.

194.23(a)(3)(ii)
Part 194 requires that mathematical models incorporate equations and boundary conditions which reasonably represent the mathematical formulation of the conceptual models.

The Design Document in Appendix CCDFGF includes a discussion of entity EN2 which does not reveal how release estimates are calculated or how interpolation is used. It also lacks detailed explanations of the equations which assign releases to cases with multiple E1, multiple E2 and multiple E1E2 type intrusions. In addition, the Design Document discussions of cuttings, blowout, and spallings releases provide insufficient information about how the actual releases are calculated. Only thumbnail sketches of how releases *could be* calculated are provided. It is not sufficient to list variables with no text discussion as to their derivation, meaning and limitations.

The CCA needs to provide pertinent documentation to support mathematical assumptions made.

194.23(a)(3)(iii)
Part 194 requires that numerical models provide numerical schemes which enable the mathematical models to obtain stable solutions.

The NUTS User's Manual contains numerous errors and omissions in the derivation of equations. Until these errors are corrected by a careful analysis of the source code for the computer program, a thorough determination of technical adequacy will not be possible.

The user's manual should be updated to include more complete equations. The following errors and omissions should be corrected:

- *Page 29, Section 4.3.8, equations 4.37 - 4.39 are incorrect.*
- *Page 38, Section 4.4.1, last paragraph: states that "we will discretize the equations in general ..." when, in fact, the equations are written for a fully implicit case only.*
- *Page 40, equation 4.79: ξ_{fi} is never defined. Further, the equation seems like it is written only for linear adsorption unless ξ_{fi} takes on a more complex meaning.*
- *Page 54, Section 4.5.1, this section defers details of colloid transport to ALGEBRA calculations and then states that maximum concentrations of colloid particulates are added to dissolved concentrations to estimate net mobilization. Equations are required here, detailing colloidal transport from generally accepted theories and noting the assumptions made to reduce it into the form being solved by NUTS, which should also be presented.*

194.23(a)(3)(iv)
Part 194 requires that computer codes accurately implement the numerical models; i.e., computer codes must be free of coding errors and must produce stable solutions.

(1) There is not enough information to evaluate the testing of the SECOTP2D analytical solution developed for DOE (page 60 of the SECO User's Manual). In addition, the application is missing the FORTRAN code used by DOE to implement this analytical solution.

The CCA needs to provide this code, as well as documentation that the code has been tested.

(2) The CCA documentation does not provide sufficient information to verify that the grid geometry used in the BRAGFLO calculations produce stable and accurate results.

The DOE needs to perform and document a grid convergence evaluation to verify that BRAGFLO and NUTS (NUTS uses the same grid to transport actinides) calculate accurate and stable results. The grid convergence evaluation should halve the grid spacing in BRAGFLO, and use a flow field with fast velocities to analyze particle transport calculated in NUTS.

194.23(c)
Part 194 requires documentation of all models and computer codes used in performance assessment calculations to be included in the application.

No testing or documentation was presented for the computer code SECO3D, the three dimensional version of the SECO code.

The CCA needs to provide testing documentation related to this code, since this code was used to develop the regional flow model that supports the use of a 2D model, as well as used in the FEP selection process to decide that the SECO two dimensional code is adequate for the CCA calculations.

194.23(c)(2)
Part 194 requires that the CCA include *detailed* instructions for executing the computer codes, including hardware and software requirements, input and output formats, listings of input and output files from a sample computer run, etc.

(1) Only brief file descriptions are provided in the SECO User's Manual.

These files must be thoroughly documented in order for EPA to perform independent testing of the SECOFL2D and SECOTP2D codes.

(2) Many of the input variables for NUTS are not adequately described in the NUTS User's Manual or in the derivation of equations in CCA Section 4. Poorly documented input variables
include the following:

- *Page 82, ADSEXPCOEFF: Not clearly defined. Is it ξ of equation 4.91? Is it X_2 of equation 4.28?*

- *Page 86, MAT_WASTE: Is input on line 12 as well as 13?*

- *Page 88: Entire page on solubility input parameters is not comprehensible, since this topic is not discussed earlier. What relations are input to the table? How is it used?*

- *Page 89: "Correlation Polynomial" [input at Line 11] is not discussed earlier.*

- *Page 89: "Contact handled inventory, remote handled inventory" [input at Line 12] is not discussed earlier. How is this implemented in the formulation and the code?*

- *Page 89: "Gas-liquid equilibrium line" [input at line 13] is not discussed earlier in the formulation.*

- *Page 99, top of page: Input on normalization factors is not discussed earlier.*

- *Page 106: Input on normalization factors not discussed earlier.*

- *Page 108: "Velocity scaling" for colloidal transport not discussed earlier, and no formulation is supplied.*

(3) Many of the input and output variables for NUTS are not adequately described in the NUTS RD/VVP or in the derivation of equations. Examples of poorly documented input variables include the following:

- *Page 51: What is R_d? It is not defined anywhere.*

- *Page 147: In the output file, CSRC and MVCPG need to be explained.*

(4) NUTS/RD/VVP Test Case #5 needs a figure depicting the conceptual model that is being simulated.

Titles for the columns need to be provided on CCA page 361.

(5) CCA page 374: Is this a mass conserved simulation? How were the two 1-D analytical solutions linked?

Please discuss. A conceptual figure is also needed.

(6) NUTS Validation Document, page 1205: oscillations in the concentration profile need explanation.

Please discuss the physical reason for these oscillations.

(7) GRASP-INV User's Manual: It is unclear whether pilot points were treated as noise-free.

If the pilot points were not treated as noise-free, then the User's Manual and CCA need to document how the standard deviation of the noise was computed. In addition, the rationale for determination of the values of kriged estimate errors at pilot point locations needs to be documented.

194.23(c)(4)
Part 194 requires detailed descriptions of data collection procedures, sources of data, data reduction and analysis, and code input parameter development.

(1) With respect to the flow and transport properties of the Culebra the CCA states, "The more recent tracer test program consisted of single-well injection-withdrawal tests and multi-well convergent flow tests." However, no references to this work are provided. In addition, the statement on CCA page 3 of Attachment 15-1 indicates that detailed descriptions of distribution coefficient laboratory studies and complete test results would appear in SNL reports by the time of submission of the CCA.

Since the results of these tests are used to support critical components of the conceptual model (e.g., matrix diffusion), it is not possible to evaluate the technical adequacy of the conceptual model without reviewing the actual test analysis. The CCA needs to identify where the field tracer and laboratory tests have been analyzed, including the analyses that justify the cross correlations for the Culebra transport parameters.

(2) Appendix MASS (Attachment 13-2) discusses the symmetry of intact rock properties and the orientation of possible gas pressure-induced fracture properties around the WIPP. However, there is insufficient information submitted in the CCA to support the assumption of radial **uniform** fracturing. Radial uniform fracturing will tend to minimize the potential transport distances and, since fracturing is only assumed to occur in the anhydrite marker beds, there is no chance that intercommunication of overlying units will occur by vertically extending fractures.

The CCA needs to include documentation to support the assumption of radical uniform fracturing.

(3) It appears that the anhydrite fracture model is simulated using a matrix porosity formulation instead of a classic fracture formulation. The use of the matrix porosity formulation inherently assumes a high fracture density; however, there appears to be no field fracture data to support the DOE approach.

The CCA needs to provide information which demonstrates that DOE's implementation of the anhydrite fracture conceptual model is appropriate.

(4) None of the references pertaining to the fracturing of the anhydrite marker beds describe how the actual data values were derived.

The CCA needs to include a quantitative argument as to why a highly simplified conceptual model is sufficient to model fracturing of the anhydrite marker beds. In addition, a detailed description of the actual data pertaining to the fracture properties (e.g., how was the data were obtained, uncertainties, limitations, etc.) is need.

(5) Appendix TFIELD: The calibrated fit to the head data is not clear and appears questionable in some cases. Only averages of residuals are presented for steady state head data, and transient data plots give no indication of the expected measurement errors. Also, a number of explanations regarding transient data mismatches need clarification: shafts were modeled as a pressure boundary instead of a flux boundary; not all pump tests were included in the fit; and Storativity is not constant across the site as modeled.

The CCA needs to discuss in detail and clarify the head residuals. More than averages for steady state are needed, and the size of the residuals should be assessed relative to the expected statistical error. The physical explanations for residual mismatches should be explained.

194.23(c)(6)
Part 194 requires an explanation of the manner in which models and computer codes incorporate the effects of parameter correlation.

Appendix MASS identifies the Culebra dolomite as an equivalent homogeneous fractured media "with no parameter cross-correlations."

The CCA needs to provide information to support the claim of no parameter correlations, including the lack of no correlation between fracture spacing and surface area. In addition, Figure 1 needs to include corresponding parameter values and a listing of where each data value and associated analysis can be located in supporting references.

Waste Characterization

194.24(a)

Part 194 requires DOE to provide information on the chemical, radiological and physical composition of waste proposed disposal at WIPP. The information must include waste components and their approximate quantities in the waste.

(1) The CCA does not provide data on the inventory of the organic compounds, phosphate, acetate, citrate, oxalate, or EDTA. DOE has indicated that these components are "negligible" or "not used" in performance assessment (Tables WCA-3 and WCA-4), implying that identification of these materials is not necessary. Nevertheless, this determination was made based upon assumed quantities and reactions, which would appear to necessitate an understanding of the quantities of these waste components present in the waste inventory.

The CCA needs to provide information pertaining to the estimated inventory of organic compounds, phosphate, and potential organic ligand.

(2) The CCA omits data concerning radionuclides Iodine 129, Technetium 99 and Tin 126, as well as data on total alpha activity.

These radionuclides were identified as important in 40 CFR 191 Appendix A; therefore, the inventory should be addressed in the CCA.

(3) TWBIR states that stored radionuclide inventories for Argonne National Laboratory-East, Argonne National Laboratory-West and Teledyne-Brown Engineering were not reported.

Provide the inventory data for Argonne National Laboratory-East and West, and Teledyne-Brown Engineering.

l94.24(c)
Part 194 requires DOE to provide information on the limiting values for individual waste components identified in 194.24(b)(2), and the associated uncertainty for each limiting value, of the total inventory of waste proposed for disposal in WIPP.

It is not clear from Appendix WCL which waste components are being limited. Further, the waste components seem to be screened out solely because of insignificant quantity in the inventory.

The CCA needs to provide consistent reporting of waste limits and their associated uncertainties. In addition, WCL should specify actual inventory values for each waste component.

194.24(c)(l)
Part 194 requires DOE to demonstrate that for the total inventory of waste proposed for disposal, the WIPP complies with the numeric requirements of section 194.34 for the waste

component limits previously identified, and for the plausible combinations of upper and lower limits of such waste components that could result in the greatest release.

While CCA Section 4.2.2 states "This following discussion is responsive to the criteria at 40 CFR 194.24(c)(1)..." it does not address the requirements of 194(c)(1).

The CCA should include a description of:

- *the plausible combinations of upper and lower limits of waste and their associated uncertainties;*
- *a rationale for the selection of these combinations;*
- *the results of the modeling run of the code using values to input parameters corresponding to values of waste components fixed at the limiting values;*
- *a demonstration that the results of the analysis show that the disposal system complies with the numeric requirements under these conditions; and*
- *documentation that the combination of these selected limits results in the greatest estimated release.*

194.24(c)(3)
Part 194 requires DOE to provide information that demonstrates that the use of process knowledge to quantify components in the waste proposed for disposal conforms with QA requirements in section 194.22.

The CCA discusses "acceptable knowledge" in lieu of process knowledge, and refers several times to the Appendix WAP for the acceptable knowledge waste characterization details. However, the Appendix WAP, Appendix C9, does not specifically address acceptable knowledge waste characterization for radiological parameters.

The CCA should provide detailed documentation that specifically addresses waste characterization via acceptable knowledge for radiological parameters. DOE should ensure that all major elements presented in Appendix WAP and Appendix C9 are addressed.

l94.24(c)(4)
Part 194 requires DOE to provide information that demonstrates that a system of controls has been and will be continue to be implemented to confirm that the total amount of each waste components will not exceed established limits under 194.24(c).

(1) Although the CCA briefly discusses the WIPP Waste Information System (WWIS), additional information is requested.

The CCA should provide information on the status and implementation of the WWIS, as well as information on "automatic limit, range, and QA checks; automatic report generation...," database security, mending database integrity and making changes to the data.

(2) Although the CCA briefly addresses the general aspects (i.e., QAPD, QAPP, QAPjP, audits, surveillances, SOPs, PDPs) of the systems for maintaining centralized control over the waste characterization activities and the authorization of grants to generator sites to characterize and ship waste to WIPP, some of the systems discussed do not address radiological waste characterization activities. For example, Page 4-48, Paragraph 3, discusses waste stream profile forms (WSPF) which do not include radiological waste characterization elements.

The CCA needs to provide information on systems for maintaining centralized control over the waste characterization activities which fully address radiological waste characterization activities.

(3) The CCA does not include any discussion on maintaining chain of custody over the waste and waste records from the point of characterization to the point of disposal.

The CCA should provide a discussion on maintaining chain of custody over the waste and waste records from the point of characterization to the point of disposal.

(4) The CCA does not include a discussion on the control procedures for the receipt of waste, which includes provisions for records and shipment surveys, acceptance and emplacement of waste, and provisions for dealing with non-conforming waste and waste records.

The CCA should provide a discussion on the controls currently in place for receipt of waste which include provisions for records and shipment surveys, acceptance and emplacement of waste, and provisions for dealing with non-conforming waste and waste records.

(5) The CCA does not provide evidence which substantiates that waste components for which inventory limits were set are monitored, controlled and accounted for in a systematic and traceable manner.

The CCA should provide evidence that substantiates that waste components for which inventory limits were set are monitored, controlled and accounted for in a systematic and traceable manner.

194.24(g)

Part 194 requires DOE to provide information that demonstrates that the inventory of waste emplaced in the disposal system complies with the limitation on transuranic waste described in the WIPP LWA.

The CCA describes the limits imposed by the LWA, but the data in the CCA do not support a determination of whether the waste inventory meets these limits. There is no information in the CCA describing the RH waste surface dose rate.

The CCA should provide information on how DOE is addressing all limitations specified in the LWA.

Future State Assumptions

194.25 (b)(1)
Part 194 requires DOE to consider futures states, and document the effects of potential future hydrogeologic, geologic, and climatic conditions on the disposal system over the regulatory time frame.

The CCA includes the impact assessment of increasing precipitation in the Culebra member. However, Dewey Lake Formation has not been assessed.

DOE should provide the impact assessment on the effects of the potential changes to hydrogeologic conditions on the Dewey Lake Formation. The potential changes on precipitation, recharge, hydraulic gradient, and characteristics needs to be included.

Scope of Performance Assessments

194.32(a)
Part 194 states that performance assessments shall consider deep drilling that may affect the disposal system during the regulatory time frame.

The connection of a Castile brine reservoir with repository waste panels has long been recognized as one of the most severe challenges to performance assessment. Scenarios concerning brine reservoirs are included in the CCA but their assumed characteristics are much different than those observed at WIPP-12, located less than 2,000 meters north of the waste panels. The principal difference is the size of brine reservoirs assumed. WIPP-12 has an estimated volume of $2.7 \times 10^{6} m^{3,}$ while brine reservoir volumes used in the CCA ranged from 1.6×10^{5} m^3 to 3.2×10^{4} m^3, with a median of 8×10^{4} m^3. DOE's rationale in the CCA for using smaller reservoirs is that larger ones would be depleted by multiple intrusion boreholes that do not strike waste. The median pore compressibility value used in the CCA (1.15×10^{-8} Pa^{-1}) is similar to the constant value used for WIPP-12 (1.45×10^{-8} Pa^{-1}). The volume of brine that would flow to the surface from a brine reservoir is:

$$\frac{\text{Volume to Surface}}{\text{Pressure Drop}} = \text{Reservoir Volume} \times \text{Pore Compressibility}$$

For WIPP-12 the volume to the surface and pressure drop were known from field

observations and thus the volume of the reservoir times the pore compressibility could be calculated to be 3.92×10^{-2} m^3 Pa^{-1}. For the median values used in the CCA, this product is only 9.2×10^{-4} (2.3% of the value for WIPP-12). The assumptions used in the CCA lead to a maximum release to the surface from an E1E2 scenario (1,000 year time for first intrusion) of about 21 m^3 (see Fig. SA-20 in Appendix SA).

The CCA needs to provide:

- *A detailed, quantitative argument justifying the conclusion that larger depressurized reservoirs are less of a problem than smaller, fully pressurized ones.*

- *A detailed, quantitative argument supporting the reservoir depletion assumptions used;*

- *Justification for the probabilities selected for the different reservoir volumes used.*

In addition, the computer models and specific modeling assumptions used to calculate the results obtained need to be made available in a usable form for reviewers.

194.32(c)
Part 194 states that performance assessments need to include an analysis of the effects on the disposal system of any activities that occur in the vicinity of the disposal system prior to disposal and are expected to occur in the vicinity of the disposal system soon after disposal. Such activities may include existing boreholes and the development of any existing leases that can be reasonably expected to be developed in the near future, including boreholes and leases that may be used for fluid injection activities.

CCA Table 6-6 (Section 6.3.1) indicates a FEP "effects of explosions" to which it refers to Section 6.4.5.3 for explanation. Section 6.4.5.3 does not explain this FEP.

The CCA needs to provide information on the "effects of explosions" FEP.

194.32(e)
Part 194 states that the CCA needs to include information that identifies all potential processes, events or sequences and combinations of processes and events that may occur during the regulatory time frame and may affect the disposal system.

(1) The CCA indicates that panel seals will prevent brine flow and radionuclide transport between panels, but fails to justify such effectiveness.

The CCA needs to include documentation that justifies the effectiveness of the panel seals in preventing brine flow and radionuclide transport between panels.

(2) CCA Section SCR 3.3.1: Neither the CCA nor the referenced FEP screening package in the Sandia Records Center (as of December 3, 1996) include a referenced study by Stoelzel and O'Brien (1996) (reference #611) which details modeling performed to assess the salt water disposal and water flooding activities outside of the WIPP LWA area.

DOE needs to provide this report.

Results of Performance Assessments

194.34(b)
Part 194 requires that probability distributions for uncertain disposal system parameter values used in performance assessments shall be developed and documented in any compliance application.

Many of the distribution functions describing the parameters used in the WIPP PA (Appendix PAR) are assumed to be uniform (*i.e.*, have equal probability for occurrence of each value of the parameter within the range between the minimum and maximum values for the parameter). DOE has employed uniform distributions for some parameter sets, as shown in the Table below, where such a selection may not be warranted. This is particularly true for the distribution coefficients (Kd's) of Am, Pu, Th, and U. Typically, distribution coefficients are reported as log uniform distributions because of the large range in their values. Use of uniform distributions, by contrast, results in relatively high mean Kd values which, in turn, would lead to under-estimations of releases of radionuclides reaching the accessible environment. For those parameter sets where the range is large (*i.e.*, where max value/min value > 10), the appropriateness of adopting a uniform distribution should be demonstrated.

The following are parameters for which DOE needs to provide justification for the selection of uniform parameter distributions:

ID	*MAT/L*	*PARAMETER*
541	*Salado Halite*	*COMP RCK*
3246	*Blowout*	*PART DIA*
2254	*Borehole*	*TAUFAIL*
3914	*Culebra*	*MINP FAC*
3487	*Culebra*	*APOROS*
3475	*U(VI)*	*MKD U*
3479	*U(IV)*	*MKD U*
3480	*PU(III)*	*MKD PU*
3481	*PU(IV)*	*MKD PU*
3478	*TH(IV)*	*MKD TH*
3482	*AM(III)*	*MKD AM*
3246	*Blowout*	*PART DIA*

As a particular example of the need to explain the basis for selecting parameter distributions, page PAR 118, lines 4-6, describes the basis for the parameter TAUFAIL as professional judgment. The CCA does not provide any information supporting the acceptability of this distribution or the range selected. In fact, use of a uniform distribution for this range of values (0.05-10) may be inappropriate. Page PAR 8 (lines 9-10) in Appendix PAR states that "use of the loguniform distribution is appropriate when all that is known about a parameter is its range (a,b), and B/A>>10; that is, the range (a,b) spans many orders of magnitude." In this case, B/A = 200.

DOE needs to provide an explanation as to why a uniform distribution was selected when the guidance suggests that a loguniform distribution is more appropriate.

Active Institutional Controls

194.41(a)
Part 194 states that the CCA should include detailed descriptions of proposed active institutional controls, the controls' location, and the period of time the controls are proposed to remain active. Assumptions pertaining to active institutional controls and their effectiveness in terms of preventing or reducing radionuclide releases should be supported by such descriptions.

The implementation time line and the description of active institutional controls do not outline the process for implementing and maintaining AICs.

The CCA should include a list or time line that outlines the major AIC milestones and actions that will taken to protect the repository in the pre- and post-closure phases. The CCA should describe how long each individual measure will continue to be effective, how it will be actively maintained, and cite empirical evidence which supports the periods of times asserted for effectiveness. For instance, when the Department asserts that a perimeter fence will be maintained for a minimum of 100 years, the Department should also identify minimum requirements for fence performance, how this will be inspected/determined, and how often and by what mechanism maintenance or replacement will be performed.

Monitoring

194.42(a)
Part 194 requires DOE to conduct an analysis of the effects of disposal system parameters on the containment of waste in the disposal system. The results of this analysis should be used to develop pre-closure and post-closure monitoring plans.

The CCA provides a list of parameters that were analyzed for their effects on the containment of waste and on the verification of performance assessment predictions. This analysis ranks the parameters as having high, medium or low effect on the containment of waste and the

verification of performance assessment predictions. The CCA provides no explanation or documentation regarding the methodology for assigning the high, medium and low designations to the various disposal system parameters analyzed.

The Department needs to provide the methodology by which the various disposal system parameters were designated as having high, medium or low effects on the containment of waste and the verification of performance assessment predictions.

Consideration of Underground Source of Drinking Water

Part 194 states that DOE should consider all underground sources of drinking water in the accessible environment that are expected to be affected by the disposal system over the regulatory time frame. Part 194 goes on to say "In determining whether underground sources of drinking water are expected to be affected by the disposal system, underground interconnections among bodies of surface water, ground water, and underground sources of drinking water shall be considered."

CCA Chapter 8 and Appendix USDW do not show the location of USDWs.

The CCA needs to include appropriate maps of USDWs using plan views with information such as township, range, and estimated latitude and longitude of the center of the USDW.